ENVIRONMENT CANADA

FISHERIES SERVICE

PROGRESS REPORT NO. 90

RIVER INVESTIGATIONS

1971

BURIN PENINSULA

-AN INVENTORY-

BY

L. G. RICHE

&

G. R. TRAVERSE

RESOURCE DEVELOPMENT BRANCH
NEWFOUNDLAND REGION
ST. JOHN'S

RIVER INVESTIGATIONS

1971

Burin Peninsula

- An Inventory -

by

Lester G. Riche

&

Gerald R. Traverse

Resource Development Branch
Department of the Environment
(Fisheries Service)
St. John's, Nfld.

September 1972

TABLE OF CONTENTS

LIST OF TABLES

List of Tables (cont'd)

List of Tables (cont'd)

List of Tables (cont'd)

List of Tables (cont'd)

LIST OF FIGURES

List of Figures (cont'd)

List of Figures (cont'd)

List of Figures (cont'd)

List of Figures (cont'd)

INTRODUCTION

This report represents the third in a continuous series of stream inventory reports for insular Newfoundland. The study started in 1967 did not develop as a workable program until 1969. Work commitments to other programs and developing a study method curtailed earlier reports. The overall program is designed to survey all rivers in Newfoundland to;

(a) allocate areas for stream clearance

(b) allocate areas for expanding salmon runs and construction of fish passage facilities

and (c) to compile an up-to-date and complete stream catalogue of island streams.

The stream inventory and river catalogue will never be complete as such. The completion of survey and write-up of all major watersheds will be completed in 1973. The inventory of secondary rivers will start as soon as the major watershed has been completed.

The effectiveness of the stream inventory has been demonstrated in the stream clearance program now in effect by the Engineering Services Group. In 1971 the stream clearance crew removed twenty-four (24) partial obstructions and completed the survey work for the removal of twenty-five in 1972. The inventory also describes a stream clearance action list of 78 partial obstructions.

The results of stream inventory are now being studied to outline plans for major fishway construction and development programs.

Materials and Methods

Each watershed was completely flown at altitudes of 100 - 150 feet using a Bell G2 helicopter. Periodic checks were made from the ground to help maintain accuracy. In addition, all obstructions and many gravel sections were viewed from the ground.

Prior to the survey, a map of each watershed to be surveyed was drawn. This map was used during the survey to mark the various pertinent features such as width, depth and bottom composition. All obstructions were accurately located and marked on the map. Each map was traced on plain white paper omitting all contour lines, other river systems, etc. This, it is found, enables the surveyor to follow the stream more easily at fairly high speed in helicopter especially in the headwaters area.

Bottom types were classified according to Lagler (1956). Percentage composition was not used. A new system, that of listing the bottom types in order of abundance or predominant types, was used. For example, if a section of river contained mainly rubble with some boulder, then that section was classified as rubble/boulder bottom. Any spawning gravel in the section was recorded as a percentage under spawning area. This it is felt gives a more realistic approximation of the available rearing and nursery area.

PIPERS HOLE RIVER

Watershed Description

Originating near the headwaters of Terra Nova River, Pipers Hole River flows southeasterly to enter the bottom of Placentia Bay near the community of Swift Current. (Fig. 1). The stream drains an area of 301.7 miles^2 and the main stem is 25.0 miles long.

The headwaters area consists mainly of standing water on a large flat plateau. Near the middle reaches, a sharp drop in elevation results in two complete obstructions, 11 miles from the mouth.

From these obstructions to the sea, the river follows a series of steps. There is a section with medium to fast flow, fairly steep gradient, and small rapids. The fast sections are interspersed with wide, gravel-sand areas with slow to medium flows. Gravel is plentiful in these sections but its spawning value is questionable due to large concentrations of sand. Excellent spawning gravel is located on tributary #5. Very little spawning gravel was located in the upper reaches.

Banks, except for some cliff in the lower reaches, are mostly flat with thick grass or brush. The immediate area is in the infancy stage of recovering from a devasting forest fire several years ago.

Three falls on the main stem all form complete obstructions.

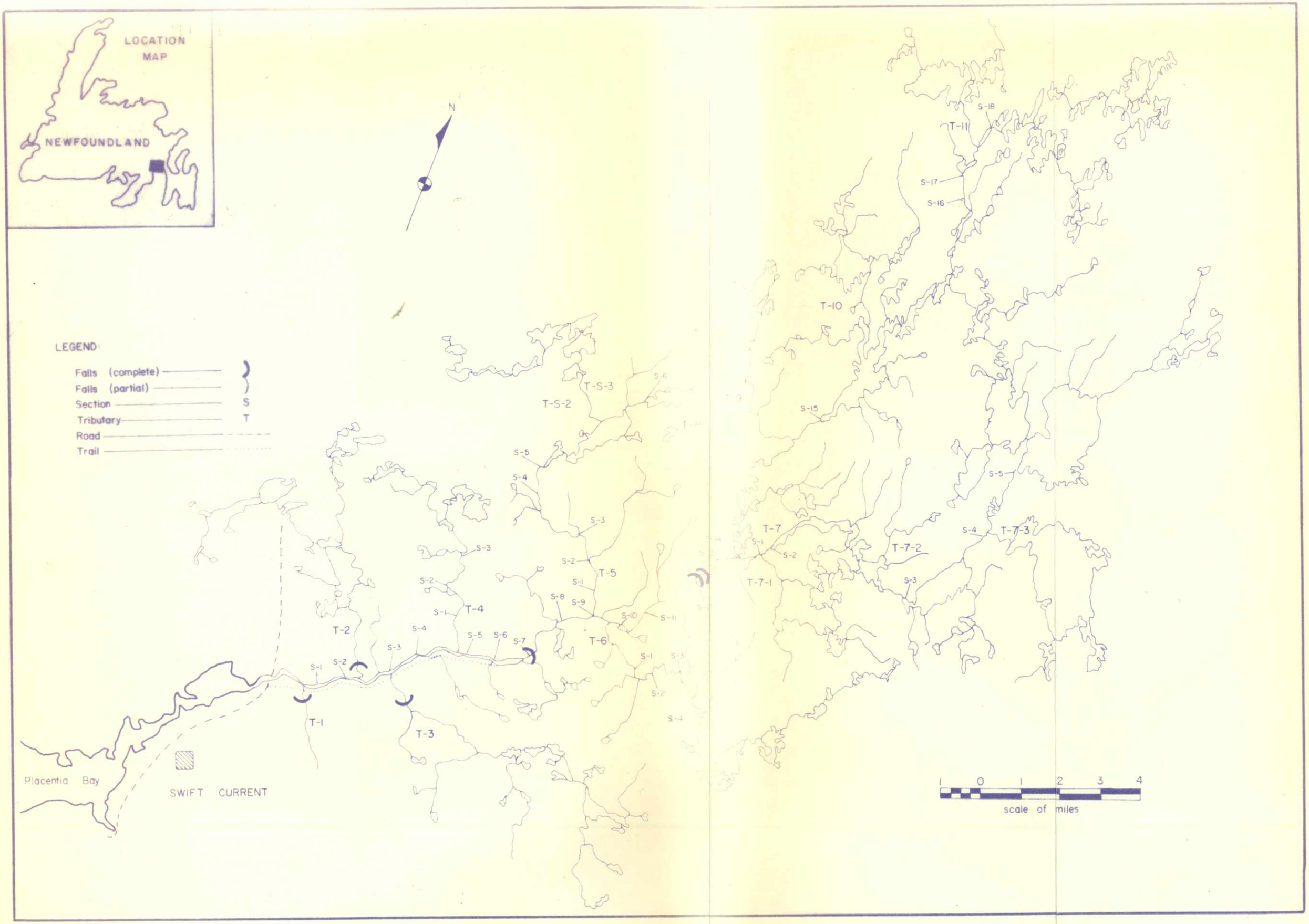

FIG. 1 OUTLINE MAP OF PIPER'S HOLE RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Fish Populations

Due to the inaccessibility of the river, angling on Pipers Hole River is confined to the area near the mouth.

Table I: Atlantic salmon angling catch, Pipers Hole River 1952 - 1971

	Total No.	Av. No. per year	Total wt. (lbs)	Av. wt. (lbs)
Grilse	637	32	2429	3.8
Salmon	11	0.5	88	8.0
Total	648	32	2517	3.9

Obstructions

There are three major obstructions on the main river. Falls #1 is 5.0 miles from the mouth and is considered to be a complete obstruction (Fig. 2). A spawning survey carried out by Conservation and Protection in 1970 is in agreement with this. No redds were observed above this falls although T- 5 contains excellent spawning gravel. The water flowing over the falls hits bedrock on the right hand side before falling into the pool. To make this falls passable, the pool below the falls must be enlarged and the overhanging lip removed from the top of the falls.

Located 11.2 miles from the mouth, falls #2 is a complete obstruction at all water levels. The falls is 30' high with a vertical drop.

Falls #3 is situated several hundred feet above #2. Total overall height is approximately 15 feet (Fig. 3). Water flowing over the falls is split three ways. The left hand side is 15' high sloping 75°; this section is not passable. The center has a 10' vertical drop at lower end, upper section is 5' high, 20' long; this part may be passable. The right hand side is 15' vertical and complete at all water levels.

Several of the tributary streams have serious obstructions. These are shown in Fig. 1.

A small falls near the mouth held up salmon during extremely low water. This falls was blasted in 1971 by the Engineering Stream Clearance crew and now presents no problem at any water level.

Fig. 2. Falls #1, Pipers Hole River, complete obstruction.

Fig. 3. Falls #3, Pipers Hole River, complete obstruction.

Bottom Composition

Table II. Bottom composition, Pipers Hole River, main river and tributaries below obstruction #1.

Section	Dist. (ft)	Width (ft)	Bottom Type	Total *Units	Rearing %	Rearing Units	Spawning (inc. in rear) %	Spawning (inc. in rear) Units
1	2000	125	boulder/rubble	278	100	278	-	-
2	4500	100	boulder/rubble/bedrock	500	90	450	-	-
3	6000	100	sand/gravel	667	30	200	10	67
4	4500	150	gravel/sand	750	70	525	60	450
5	7000	100	rubble/boulder	778	70	545	60	467
6	4000	100	gravel/rubble	444	100	444	70	311
7	2500	125	rubble/boulder	347	100	347	10	35
T-2	1500	30	gravel/rubble	50	100	50	70	35
T-3	4000	20	gravel/rubble	88	100	88	70	62
T-4-S-1	4500	15	rubble/boulder	75	80	60	-	-
T-4-S-2	4500	60	steadies	300	-	-	-	-
T-4-S-3	4000	15	rubble/boulder	67	100	67	-	-
TOTAL				4344	70.3	3054	32.8	1427

Tributaries #1, 2 and 3 are blocked by complete obstructions a short distance from the mouth. The area above these obstructions is not included in Table II.

* one unit = 100 yds^2

Fig. 4. Spawning Area, Pipers Hole River, lower reaches.

Fig. 5. Rearing area, Pipers Hole River, lower reaches.

Fig. 6. Headwaters, Pipers Hole River.

Table III: Bottom composition, Pipers Hole River, main river and tributaries between obstruction #1 and #2.

Section	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units (inc. in rear.)
8	10,000	100	rubble/boulder	1111	100	1111	-	-
9	5,000	70	steadies	389	-	-	-	-
10	4,000	100	rubble/gravel	444	100	444	20	89
11	4,000	100	rubble/boulder	444	100	444	-	-
12	6,000	100	rubble/boulder /gravel	667	100	667	10	67
T-5-S-1	2,000	25	gravel/rubble	56	100	56	90	50
T-5-S-2	5,000	25	rubble/gravel	139	100	139	50	70
T-5-S-3	3,500	25	rubble/boulder	97	100	97	5	5
T-5-S-4	12,000	25	rubble/gravel	333	100	333	30	100
T-5-S-5	3,500	40	steadies	156	-	-	-	-
T-5-S-6	3,000	10	rubble/boulder	33	100	33	10	3
T-5-1	4,000	10	rubble/boulder	44	100	44	-	-
T-5-2	7,000	15	rubble/boulder	117	100	117	5	6
T-5-3	5,000	10	rubble/boulder	56	100	56	10	6
T-6-S-1	7,500	20	rubble/boulder /gravel	167	100	167	10	17
T-6-S-2	4,000	25	steadies	111	-	-	-	-
T-6-S-3	6,000	15	rubble/boulder	100	100	100	-	-
T-6-S-4	6,000	20	steadies	133	-	-	-	-
Totals				4597	82.8	3808	9.0	413

Table IV: Bottom composition, Pipers Hole River, Main River and tributaries above obstruction #3.

Section	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing)
13	5500	75	boulder/rubble/ bedrock	458	95	435	-	-	
14	4000	100	boulder/rubble	444	100	444	-	-	
15	6000	75	boulder/rubble	500	100	500	-	-	
16	4000	40	steadies	178	-	-	-	-	
17	2000	30	boulder/rubble	67	100	67	-	-	
18	8000	50	steadies	444	-	-	-	-	
T-7-S-1	3000	75	steadies	250	-	-	-	-	
T-7-S-2	2000	40	rubble/boulder	89	100	89	-	-	
T-7-S-3	4000	70	rubble/boulder	311	100	311	-	-	
T-7-S-4	4500	70	rubble/boulder	350	100	350	5	5	
T-7-S-5	12000	50	steadies	667	-	-	-	-	
T-7-1	4500	10	rubble/boulder	50	100	50	-	-	
T-7-2	4500	10	rubble/boulder	50	100	50	-	-	
T-7-3	4000	40	rubble/boulder	178	100	178	-	-	
T-8-S-1	2000	10	rubble/boulder	22	100	22	-	-	
T-8-S-2	2000	20	steadies	44	-	-	-	-	
T-9	4500	10	rubble/gravel/ boulder	50	100	50	20	10	
T-10	12000	50	steadies	667	-	-	-	-	
T-11	6000	15	boulder/rubble	100	100	100	-	-	
Total				4919	53.8	2646	0.3	15	

Table V: Summary, bottom composition, Pipers Hole River and accessible tributaries

	Rearing units	Spawning units (inc. in rearing)
Main river & tributaries below obstruction #1	3054	1427
Main river and tributaries between obstructions #1 and #2	3808	413
Main river & tributaries above obstruction #3	2646	15
Total	9508	1855

Potential Population Estimation

Table VI: Estimated Atlantic salmon smolt and adult sea survival, Pipers Hole River, below obstruction #1.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		3054	6108	9162
Adult return if sea survival is	5%	153	305	458
	10%	305	611	916
	15%	458	916	1374
	20%	611	1222	1832
	25%	764	1527	2291

Table VII: Estimated Atlantic salmon smolt and adult sea survival, Pipers Hole River and tributaries between obstructions #1 and #2.

If smolt production per 100 yards^2 is		1	2	3
Smolts produced		3808	7616	11424
Adult return if sea survival is	5%	190	381	571
	10%	381	762	1142
	15%	571	1142	1714
	20%	762	1523	2285
	25%	952	1904	2856

Table VIII. Estimated Atlantic salmon smolt and adult sea survival, Pipers Hole River and tributaries above obstruction #3.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		2646	5292	7938
	5%	132	265	397
	10%	265	529	794
	15%	397	794	1191
	20%	529	1058	1588
	25%	662	1323	1985

Summary

The main stem and tributaries of Pipers Hole River offers an additional 6454 suitable units of rearing with plenty of suitable spawning areas, if the three obstructions located on the main river are opened to upstream migration. This would realize an additional 1900 salmon produced back to the local area, or adjacent bays. (This figure is derived from 2 smolt per unit and 15% sea survival). At 60% commercial take, 800 would return to the local sports creel.

Recommendations

Cost for removal of these obstructions should be assessed for final priority ranking.

SANDY HARBOUR RIVER

Watershed Description

Sandy Harbour River originates near the headwaters of Long Harbour River in Fortune Bay. It flows southeasterly to enter the west side of Placentia Bay near the abandoned settlement of Prowseton (fig. 7). The stream has a drainage area of 178.3 miles^2 and a total axial length of 27.0 miles.

From the mouth to falls #2, the river is generally fast moving with large deep pools, steep banks and cliffs with bottom composition mostly boulder with limited rubble.

Beyond falls #2, the river widens considerably, the current slows and banks become less steep. In the middle and upper reaches several sections of steady areas are encountered between rearing and spawning areas. These steady sections are characterized by very slow current and practically 100% sand.

Both rearing and spawning areas are well distributed on the main river and accessible tributaries. Some gravel areas are of poor quality due to large concentrations of sand. However, ample spawning grounds of good quality are available throughout the system.

Three obstructions are situated on the main stem; two are temporary holdups, the other is a complete obstruction at all water levels (fig. 9). The majority of tributaries in the lower reaches are blocked by high falls close to the mouth (fig. 7).

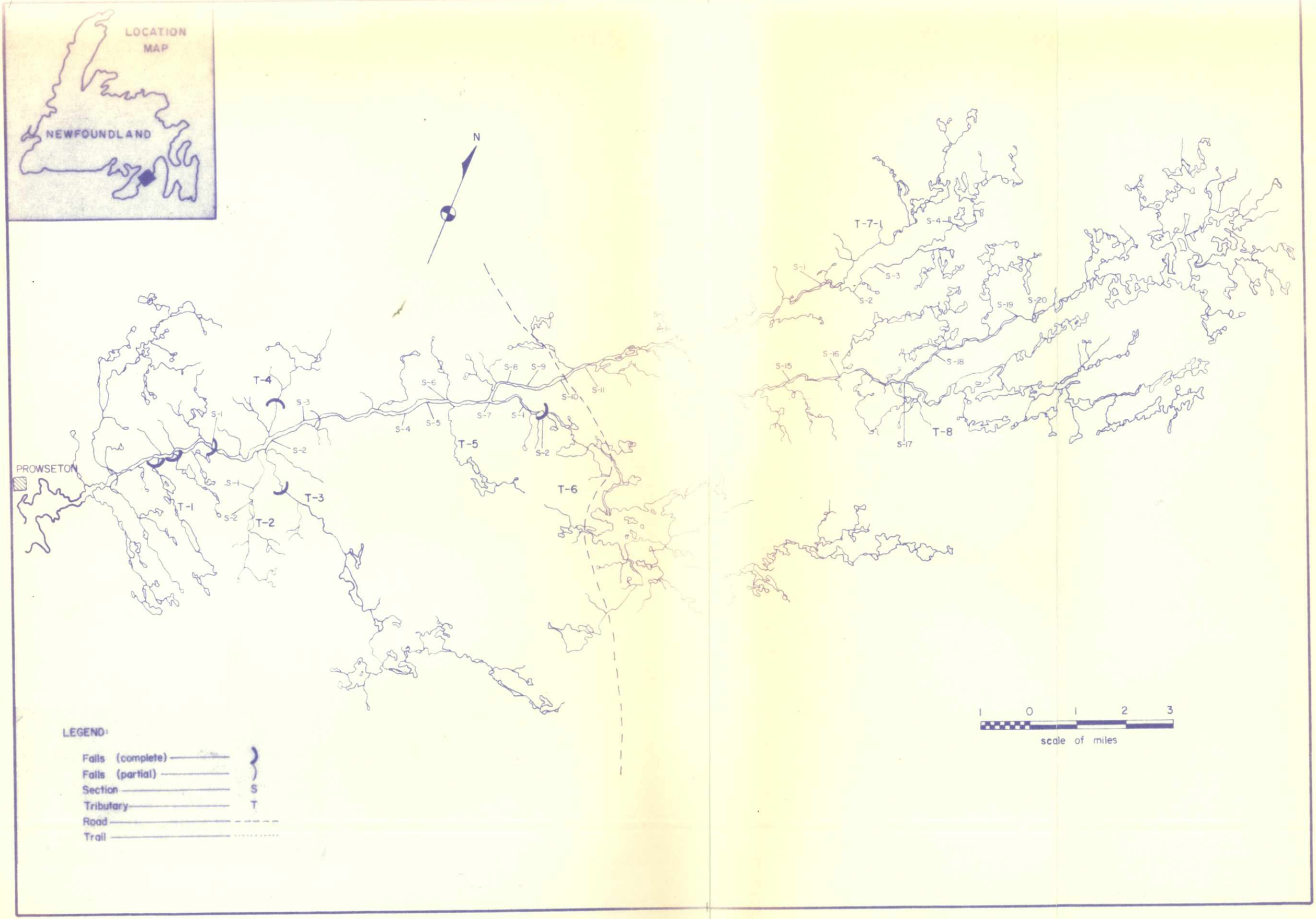

FIG. 7 OUTLINE MAP OF SANDY HARBOUR RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Fish populations

There are no angling records available for Sandy Harbour River. The stream is located in an isolated region and is not scheduled. Reports indicate there is a small run of Atlantic salmon below the impassable falls.

Obstructions

There are three obstructions on the main river. A 5' sloping falls at the mouth is a temporary holdup during low tide (fig. 8). Some minor blasting is required to remove outcrops of bedrock and confine water flow. Falls #2 is a complete obstruction and is located 2.5 miles from the mouth (fig. 9). This falls is approximately 18' vertical. The falls measures only 5' across the top and the flow is restricted by a large section of bedrock. There is also an overhanging lip on the falls. An engineering survey is needed here to determine the proper and most effective way to remedy this obstruction.

Falls #3 is located 5 miles from the mouth (fig. 10). The falls is divided by a huge section of bedrock. The right hand side had a 10' vertical drop with an overhanging lip and a 15' chute at 60° slope. This side is a complete obstruction at all water levels. The left hand side has 3 drops 5' at 50°, 6' at 55° and 2' vertical with a small pool between each drop. Above this there is a pool that leads to a 20' long, 2' wide chute at a slope of 15° - 20°. There is a 7' vertical falls at the top of this chute. This side is estimated to be passable with difficulty at low and medium water levels. If a fishway is built over falls #2 in the future, blasting will be required here for easy access to the middle and upper reaches of the river.

All the major tributaries in the lower reaches have serious complete obstructions fairly close to the mouth (fig. 7). No work is necessary on these because of the limited rearing potential.

Fig. 8. Falls #1, mouth of Sandy Hr. River, partial obstruction.

Fig. 9. Falls #2, Sandy Hr. River, complete obstruction.

Fig. 10. Falls #3, Sandy Harbour River, partial obstruction

Bottom Composition

Table IX: Bottom composition, Sandy Harbour River, from mouth to obstruction #2.

Section	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc in rearing
1	12,000	70	boulder/rubble	933	98	914	3	28	

Table X: Bottom composition, Sandy Harbour River, main stem above obstruction #2.

Section	Dist (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing
2	6800	75	rubble/gravel/ boulder	566	100	566	40	226	
3	6000	60	boulder/rubble	400	100	400	-	-	
4	9500	125	gravel/rubble/ bedrock	1319	95	1253	80	1002	
5	2000	125	steady	278	-	-	-	-	
6	2500	150	sand/gravel	417	25	104	5	21	
7	4500	125	gravel/sand	625	50	313	10	63	
8	2500	100	sand/gravel	278	25	70	10	28	
9	1500	100	rubble/gravel	167	100	167	10	17	
10	5000	125	sand/gravel	694	10	69	5	35	
11	2500	100	steady	278	-	-	-	-	
12	11000	90	rubble/boulder	1100	100	1100	5	555	
13	3000	40	rubble/boulder/ bedrock	133	85	113	-	-	
14	3500	50	steady	194	-	-	-	-	
15	7500	40	rubble/boulder/ sand	333	85	283	5	17	
16	6000	40	steadies	266	-	-	-	-	

Table X: (cont'd)

Section	Dist (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units (inc in rearing
17	7500	30	rubble/boulder/ gravel	250	100	250	15	38
18	4000	30	rubble/gravel	133	50	67	10	13
19	9500	45	steadies	475	-	-	-	-
20	1500	20	rubble/gravel	33	100	33	20	7
Total				7939	60.3	4788	19.2	1522

Several tributaries are blocked by complete obstructions (fig. 7). Rearing areas above these obstructions have not been included in the estimates due to the limited area available and the seriousness of the obstructions.

Fig. 11. Rearing area on upper reaches of Sandy Hr. River

Table XI: Bottom composition accessible tributaries of Sandy Harbour River.

Section	Dist (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc in rearing
T-2-S-1	4500	15	rubble/gravel	75	100	75	15	11	
T-2-S-2	1500	15	boulder/rubble	25	100	25	-	-	
T-3	4500	20	boulder/rubble/gravel	100	100	100	5	5	
T-4	5500	15	boulder/rubble	92	100	92	-	-	
T-5	7000	10	rubble/boulder	78	100	78	-	-	
T-6-S-1	5500	25	rubble/gravel	153	100	153	20	31	
T-6-S-2	2000	20	boulder/rubble	45	100	45	-	-	
T-7-S-1	17000	30	rubble/boulder/gravel	567	100	567	15	85	
T-7-S-2	1500	30	steady	50	-	-	-	-	
T-7-S-3	6000	20	gravel/rubble	133	100	133	80	106	
T-7-S-4	14500	20	rubble/gravel/boulder	322	100	322	20	65	
T-7-1-S-1	3000	20	gravel	67	80	54	100	67	
T-7-1-S-2	7000	15	rubble/boulder	117	100	117	5	6	
Total				1824	96.5	1761	20.6	376	

Table XII: Summary bottom composition, Sandy Harbour River

	Rearing Units	Spawning Units	(inc. in rearing)
Main river below complete obstruction	914	28	
Main river above complete obstruction	4788	1522	
Tributaries above complete obstruction	1761	376	
Total	7463	1926	

Potential Population Estimation

Table XIII: Estimated Atlantic salmon smolt production and adult sea survival, Sandy Harbour River below complete obstruction.

If smolt production per 100 yds.^{2} is		1	2	3
Smolts produced		914	1828	2742
Adult return if sea survival is	5%	46	91	137
	10%	91	183	274
	15%	137	274	411
	20%	183	366	548
	25%	229	457	686

Table XIV: Estimated Atlantic salmon smolt production and adult sea survival, Sandy Harbour River and accessible tributaries above complete obstruction.

If smolt production per 100 yds^2 is		1	2	3
		6549	13098	19647
Adult return if sea survival is	5%	327	655	982
	10%	655	1310	1965
	15%	982	1965	2947
	20%	1310	2620	3929
	25%	1637	3275	4912

Summary

The removal of one obstruction (Falls #2, fig 9) would provide rearing area for the total production of 1965 adult salmon or a river escapement of 800 salmon.

Recommendations

Engineering investigation on cost for removal of falls #2 for final priority ranking.

PARADISE RIVER

Watershed Description

Originating near the headwaters of Long Harbour River in Fortune Bay, Paradise River flows southeasterly to enter the bottom of Paradise Sound on the west side of Placentia Bay (fig. 12). With a drainage area of 189.3 miles^2 and an axial length of 31.4 miles, the stream is the largest on the Burin Peninsula.

From the mouth to falls #1, the river is narrow and turbulent with sheer bedrock cliffs on both sides. Above this falls, the river widens abruptly and continues as such to the upper reaches except for a few constrictions in the area of each falls. Several steady areas of sand are located along the river course. These areas have not been included in rearing potential due to lack of information on the contribution of this type of habitat to salmon rearing. Spawning and rearing areas are well distributed throughout the main river and tributaries (table XVI - XVIII).

Tributaries are mostly small, except for T-8, and the majority of them are blocked at some point by complete obstructions (fig. 12).

There are five falls on the main river, three of which are complete obstructions. Two of these could be made passable relatively easy. The other would require major work.

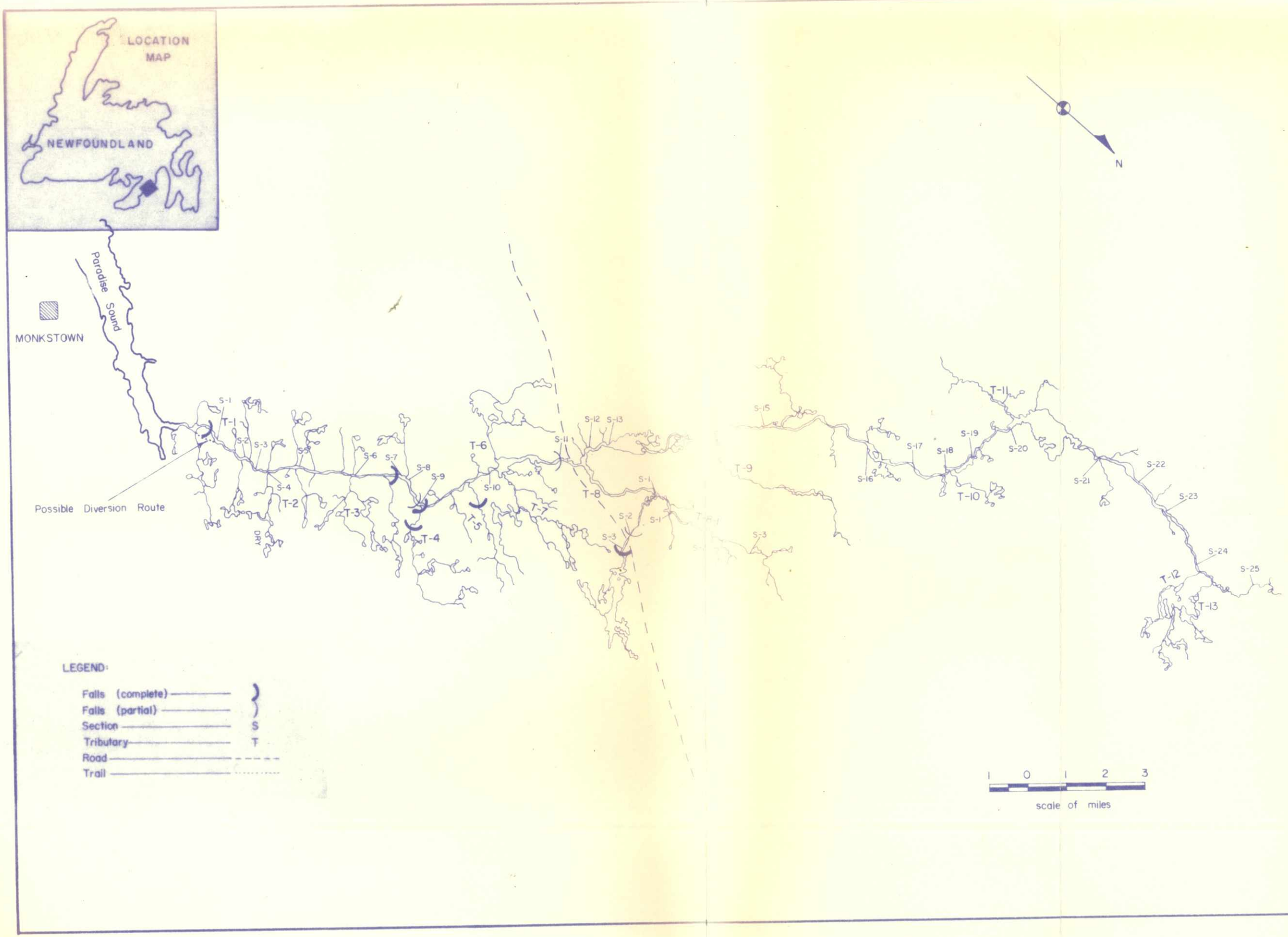

FIG. 12 OUTLINE MAP OF PARADISE RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Fish populations

This stream has never been scheduled; salmon and sea-run trout are not known to exist here. Anadromous fish could only penetrate the river for one-quarter mile or less due to a 45' vertical falls. The area from the falls to the mouth is a rough gorge section consisting mostly of bedrock and large boulders with no spawning areas (fig. 14).

Resident brook trout occur throughout the system.

Obstructions

Five falls are located on the main river, three of which are complete obstructions (fig. 13 to fig. 17). Several of the tributaries have complete obstructions. Due to the limited area above, these do not warrant further investigation (fig. 12). Table XV lists the various obstructions and their location from the mouth.

Table XV. Obstructions, main stem of Paradise River

Obst. No.	Obst. type	Location from mouth	Description	Degree of obstruction	Recommended improvements
1	falls	0.25 mi	45' vertical	complete	divert river around falls if feasible. Engineering survey requird.
2	falls	6.0 mi.	12' vertical run-around right hand side	complete	needs blasting to move more water through run-around.
3	falls	6.6 mi.	4' vertical	minor holdup	no work needed
4	falls	6.7 mi.	15' high, 25' long, @ 50° angle	extremely difficult possibly complete	blasting to confine water at top of falls. Engineering survey.
5	falls	11.3	21' high overall 50° angle. Several short drops fish could move up diagonally.	holdup at low water	requires blasting to confine water

Falls #1 is approximately 45' vertical. It is situated at the upper end of a long narrow gorge. This gorge has 50' high vertical cliffs on each side and is approximately one-quarter mile long (fig. 14). Construction of a fishway here would be extremely expensive. An Engineering survey should be undertaken to determine the feasibility of a diversion route indicated in fig. 12.

Fig. 13. Falls No. 1, Paradise River, complete obstruction

Fig. 14. "Tunnel" (1000' long) below falls no. 1

Fig. 15. Falls No. 2, Paradise River, complete obstruction

Fig. 16. Falls no. 4, Paradise River, complete obstruction

Fig. 17. Falls no. 5, Paradise River, partial obstruction

Bottom Composition

Table XVI: Bottom composition, Paradise River, between obstruction #1 and #2.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing
1	3,000	150	rubble/gravel/ boulder	500	100	500	10	50	
2	4,000	100	boulder/rubble	444	100	444	-	-	
3	2,500	150	sand/rubble/ gravel	417	50	209	10	42	
4	2,000	60	boulder/rubble	133	100	133	-	-	
5	4,000	150	gravel/rubble	667	100	667	60	400	
6	8,000	125	gravel/sand/rubble	1111	75	833	60	667	
7	6,000	125	gravel/sand/rubble	833	80	666	70	583	
T-1	6,500	10	boulder/rubble	72	100	72	-	-	
T-2	4,000	10	boulder/rubble	44	100	44	-	-	
T-3	8,000	10	boulder/rubble	89	100	89	-	-	
Total				4310	84.8	3657	40.4	1742	

Table XVII: Bottom composition, Paradise River, between obstructions #2 and #3.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing
8	1,500	100	boulder/rubble	167	100	167	-	-	
9	4,500	125	rubble/gravel	625	100	625	5	31	
T-4	4,000	10	boulder/rubble	44	100	44	-	-	
Total				836	100	836	3.7	31	

Fig. 18. Rearing Area, Paradise River, approximately 1/3 mile from mouth

Fig. 19. Rearing-spawning area, upper reaches of Paradise River

Table XVIII: Bottom composition, Paradise River and accessable tributaries, above falls #4.

Section	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc in rearing
10	12,000	120	boulder/bedrock	1,600	90	1440	-	-	
11	12,000	125	sand/steady	1,667	-	-	-	-	
12	4,000	100	boulder/rubble/b bedrock	444	98	435	-	-	
13	3,000	125	steadies	417	-	-	-	-	
14	12,000	125	steadies	1,667	-	-	-	-	
15	6,500	80	rubble/boulder	578	95	549	5	29	
16	14,000	125	steadies	1,944	-	-	-	-	
17	6,000	60	gravel/rubble	400	100	400	70	280	
18	4,000	60	rubble/boulder	267	100	267	-	-	
19	2,500	60	rubble/gravel	167	100	167	20	33	
20	12,000	60	boulder/rubble	800	90	720	-	-	
21	4,000	60	steadies	267	-	-	-	-	
22	6,000	40	boulder/small gravel	267	60	160	90	240	
23	6,000	30	rubble/gravel /boulder	200	100	200	20	40	
24	9,000	30	rubble/gravel/ boulder	300	100	300	25	75	
25	4,000	30	rubble/boulder	133	100	133	-	-	
T-5	2,000	10	boulder/rubble	22	100	22	-	-	
T-6	5,500	15	rubble/boulder	92	100	92	-	-	
T-7	8,000	10	rubble/gravel	89	100	89	5	4	
T-8-S-1	16,000	60	steadies	1,067	-	-	-	-	
T-8-S-2	6,000	30	boulder/rubble	200	100	200	5	10	
T-8-S-3	6,000	30	rubble/gravel/ boulder	200	100	200	10	20	
T-8-1-S-1	4,000	40	steadies	178	-	-	-	-	
T-8-1-S-2	4,500	30	rubble/boulder	150	100	150	5	8	
T-8-1-S-3	6,500	30	boulder/rubble	217	100	217	-	-	

Table XVIII: (cont'd)

Section	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc in rearing
T-9	14,000	25	rubble/gravel	389	100	389	30	117	
T-10	6,000	15	boulder/rubble	100	100	100	-	-	
T-11-S-1	4,000	30	steady	133	-	-	-	-	
T-11-S-2	4,000	15	boulder/rubble	67	100	67	2	1	
T-12	3,000	5	rubble/boulder	17	100	17	-	-	
T-13	3,000	10	rubble/boulder	17	100	17	-	-	
Total				14,056	45.0	6,331	6.1	857	

Table XIX: Summary, bottom composition, Paradise River.

	Rearing units	Spawning units (inc. in rearing)
Main river & tributaries between falls #1 and #2.	3,657	1,742
Main river & tributaries between falls #2 and #3, #4.	836	31
Main river & tributaries above falls #4.	6,331	857
Total	10,824	2,630

Potential Population Estimation

Table XX: Estimated Atlantic salmon smolt production and adult sea survival, Paradise River.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		10,824	21,648	32,472
Adult return if sea survival is	5%	541	1,082	1,624
	10%	1,082	2,165	3,247
	15%	1,624	3,247	4,871
	20%	2,165	4,330	6,494
	25%	2,706	5,412	8,118

Summary

Five obstructions on the main stem of Paradise River prevents salmon from utilizing some 10,824 units of potential rearing area. The first obstruction located 0.25 miles from the mouth is complete, at 45' high. This would require intensive engineering work. The others are of a less serious nature but still require engineering investigations.

Recommendations

Engineering survey of all obstructions on Paradise River for final priority ranking.

BLACK RIVER
(Paradise Sound)

Watershed Description

Originating in the Terrenceville area of the Burin Peninsula, Black River flows southeasterly to enter the bottom of Paradise Sound on the west side of Placentia Bay. Black River has a drainage area of 79.3 miles^2 and an axial length of 9.5 miles.

From the mouth to pond #1, the stream is laced with a continuous series of falls and rapids (fig. 20). The river in this section is narrow and turbulent with deep pools and steep bedrock cliffs. As you near the middle reaches the stream widens, banks become less steep and a rubble boulder bottom predominates. Rearing areas are abundant but spawning gravel is scarce (Table XXII to XXIV). The upper watershed is barren with scattered patches of trees while the lower reaches are well forested. Aquatic insects were numerous throughout the system.

Fish Populations

This stream has never been a scheduled river and little is known of anadromous fish runs. Only a few resident trout were observed during the survey.

LEGEND:

Falls (complete) ———)
Falls (partial) ———)
Section ——— S
Tributary ——— T
Road ——— - - - -
Trail ——— .....

FIG. 20 OUTLINE MAP OF BLACK RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Obstructions

From the mouth to the first pond, a distance of three miles, there are eleven falls and several rapids (Table XXI). Three of these are complete obstructions and several others require blasting. Falls #10 may be improved by raising the water level in the pool and blasting off the overhanging lip. There is one partial obstruction 1/4 mile above pond #1. The remainder of the main stream is free from obstructions.

Tributary #1, the largest tributary, is blocked three miles from the mouth by a 30' falls. Other tributaries on the system are accessible.

Table XXI: Obstructions, main stem, Black River.

No. obst.	Type obst.	Distance fr.mouth	Description	Degree of obstruction	Recommended improvement
1	falls	2000'	8' high @ 70°	minor holdup	no work required
2	falls	2300'	12' high in 2 drops 45' long, 45° slope	no obstruction	
3	falls	2400'	12' vertical overhanging lip	complete all levels	blasting to remove bedrock outcrops and lower top of falls
4	falls	2450'	4' vertical	no obstruction	no work required
5	falls	2650'	5' vertical on RHS, 5' high 15' long LHS	no obstruction	no work required
6	falls	2750'	8' vertical	holdup all levels	blasting to remove overhanging lip
7	falls	2850'	10' high, 25' long at 45°	holdup all levels	blasting
8	falls	2950'	5' high, 30' long, 30° slope	no obstruction	no work required
9	falls	3050'	12' in 2 drops upper 3' at 45° lower 9' vertical LHS 70° RHS	complete all levels, occasional fish may get over at low water	extensive blasting; possibly fishway may be required
10	falls	2 mi.	15' vertical overhanging lip	complete all levels	blasting overhanging lip, raise water level in pool below
11	falls	3 mi.	12' overall height lower 7' vertical, upper 5' @ 30°, pool between	holdup high water current may be too strong	removal of bedrock to widen falls
12	falls	4.5 mi.	14' overall height 35' long @ 45° angle	no obstruction fish can move up diagonally across the falls	no work required

Fig. 21. Falls No. 1, 2000' from mouth of Black River, partial obstruction

Fig. 22. Falls No. 3, 2400' from mouth of Black River, complete obstruction

Fig. 23. Falls No. 6, 2750' from mouth of Black River, partial obstruction

Fig. 24. Falls No. 10, 2 mi. from mouth of Black River, complete obstruction

Fig. 25. Falls No. 11, 3 mi. from mouth of Black River, partial obstruction

Fig. 26. Falls No. 12, 4.5 mi. from mouth of Black River, partial obstruction

Bottom Composition

Table XXII: Bottom composition, Black River and tributaries between obstructions #9 and 10.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rear)
1	2,500	50	boulder/bedrock	139	80	111	-	-	
2	2,000	50	boulder/bedrock	111	70	78	-	-	
T-1-S-1	1,500	30	boulder/rubble	50	100	50	-	-	
T-2-S-2	5,000	30	gravel/rubble	167	100	167	80	134	
T-3-S-3	1,000	20	boulder/rubble	22	100	22	-	-	
Total				489	87.5	428	27.4	134	

Table XXIII: Bottom composition, Black River between obstructions #10 and 11.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rear.
3	6,000	50	boulder/bedrock	333	80	266	-	-	
Total				333	80	266	-	-	

Table XXIV: Bottom composition, Black River and tributaries above obstruction #11.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing
4	4,000	70	boulder/bedrock	311	90	280	-	-	
5	2,000	60	boulder/rubble	133	100	133	-	-	
6	1,500	30	rubble/boulder	50	100	50	-	-	
7	5,000	25	rubble/gravel/ boulder	139	100	139	20	28	
T-2	6,000	15	rubble/boulder	100	100	100	-	-	
T-3-S-1	4,500	20	rubble/gravel	100	100	100	40	40	
T-3-S-2	2,500	15	boulder/rubble	42	100	42	-	-	
T-4-S-1	1,500	30	rubble/boulder	50	100	50	-	-	
T-4-S-2	1,000	20	boulder/rubble	22	100	22	-	-	
T-4-S-3	5,000	10	rubble/boulder	56	100	56	2	1	
T-5	5,000	25	steady	139	-	139	-	-	
Total				1,142	97.3	1,111	6.0	69	

Table XXV: Summary, bottom composition, Black River and tributaries.

	Rearing	Spawning (inc. in rearing) Units
Main river and tributaries between obstructions #9 and 10.	428	134
Main river and tributaries between obstructions #10 and 11	266	-
Main river and tributaries above obstruction #11	1,111	69
Total units	1,805	203

Potential Population Estimation

Table XXVI: Estimated Atlantic salmon smolt production and adult sea survival - Black River and tributaries.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		1,805	3,610	5,415
Adult return if sea survival is	5%	90	181	271
	10%	181	361	542
	15%	271	542	812
	20%	361	722	1,083
	25%	451	903	1,354

Summary

The removal of twelve (12) obstructions, four of which are complete on Black River would make available 1800 units of suitable rearing area. Cost of removal could be high for such a low production. Cost analysis for removal however could be undertaken.

Recommendations

Engineering surveys to determine costs, however, a low priority is recommended for this survey.

NONSUCH RIVER

Watershed Description

This small stream originates on the east side of the Burin Peninsula and flows southwesterly to enter Placentia Bay 5 miles north of the village of Petit Forte (now abandoned) (fig. 27). Nonsuch River has a drainage area of 11.6 miles^2 and an axial length of 7.3 miles.

Spawning gravel is plentiful and of excellent quality in the lower reaches (fig. 29). The upper section contains excellent rearing areas but lack suitable spawning gravel (Table XXVIII). River banks in lower reaches are gentle in slope and grass covered. Upper sections have steep banks and well forested providing excellent shade. Pools on the system are fairly small. One small obstruction at the mouth holds up fish at low water levels.

Fish populations

Atlantic salmon - angling statistics for Nonsuch River are not available before 1963. Fishing effort on this stream has been low due to its inaccessibility. In 1963, 20 fish were angled with only 6 rod days recorded. In 1969, 6 fish were taken in 2 rod days. No reports are available for 1970 and 1971.

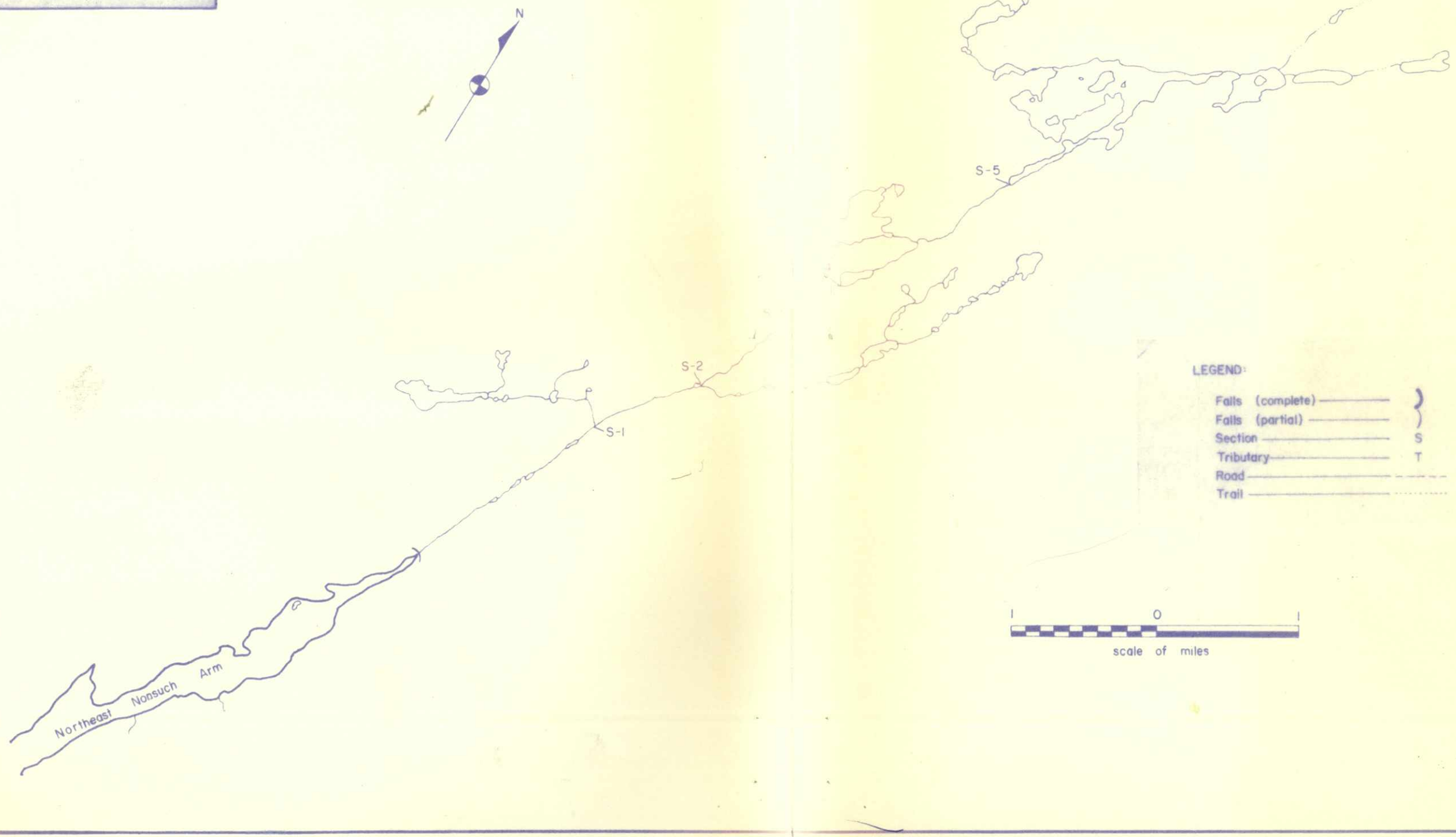

FIG 27 OUTLINE MAP OF NONSUCH RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Table XXVII: Atlantic salmon, angling catch, Nonsuch Brook 1963, 1965, 1966, 1968 and 1969.

	Total number	Av.no. per year	Total wt. (lbs)	Av. wt. (lbs)
Grilse	36	7	142	3.9
Salmon	-	-	-	-
Total	36	7	142	3.9

A large population of sea-run brook trout are known to run into this stream each year. Statistics on the runs are not available.

Obstructions

There is one partial obstruction on this river system. A 5' vertical falls with an overhanging lip is located at the mouth (Fig. 28). Water spreads thinly over top of falls at low flow periods. Blasting is required here to confine water and remove overhanging rock.

Fig. 28. Falls at mouth of Nonsuch River, partial obstruction at low flow

Bottom Composition

Table XXVIII: Bottom composition, Nonsuch River.

Sect.	Dist. (ft)	Av.width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing)
1	8500	50	gravel/rubble	472	100	-	95	448	
2	4000	35	rubble/gravel	156	100	-	30	47	
3	4000	25	rubble/boulder	111	100	-	-	-	
4	2500	20	boulder/rubble	56	100	-	-	-	
5	6500	30	boulder/rubble	217	100	-	-	-	
Total				1012	100	1012	48.9	495	

There are a couple of small intermittent tributaries on this stream. These do not contain any potential for Atlantic salmon rearing or spawning areas.

Potential Population Estimation

Table XXIX: Estimated Atlantic salmon smolt production and adult sea survival - Nonsuch River.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		1012	2024	3036
Adult return if sea survival is	5%	51	101	152
	10%	101	202	304
	15%	152	304	455
	20%	202	405	607
	25%	253	506	759

Fig. 29. Spawning gravel in lower reaches of Nonsuch River

Fig. 30. Rearing area in upper reaches of Nonsuch River

Summary

This river has little in the way of obstructions to upstream migrants, except for a small falls near the mouth.

Recommendations

Removal of the falls near the mouth when engineering crew in this area. Priority low.

CAPE ROGER RIVER

Watershed Description

Cape Roger River flows into Placentia Bay on the east side of the Burin Peninsula near the abandoned community of St. Joseph's (fig. 31). It has a drainage area of 35.8 miles^2 and a total axial length of 12.6 miles.

There are no holdups to migrating salmon or sea trout on the main stem. A falls, 1½ miles from the mouth, presents no problem. Remedial work in 1956 (fig. 32) provided continuous passage. Two of the four tributaries are blocked by falls but have little or no potential above.

The lower reaches of the river are mostly boulder/rubble composition with well forested river banks. Most of the spawning area is located in the middle section (fig. 35). Heavy vegetation in lower reaches gives way to patches of trees and barrens upstream. This river has excellent spawning and rearing areas with pools distributed throughout the system.

Fish Populations

Table XXX: Atlantic salmon angling catch, Cape Roger River, 1953-1971

	Total number	Av. no. per year	Total wt (lbs)	Av. wt. (lbs)
Grilse	2460	129	9375	3.8
Salmon	10	0.5	69	6.9
Totals	2470	130	9444	3.8

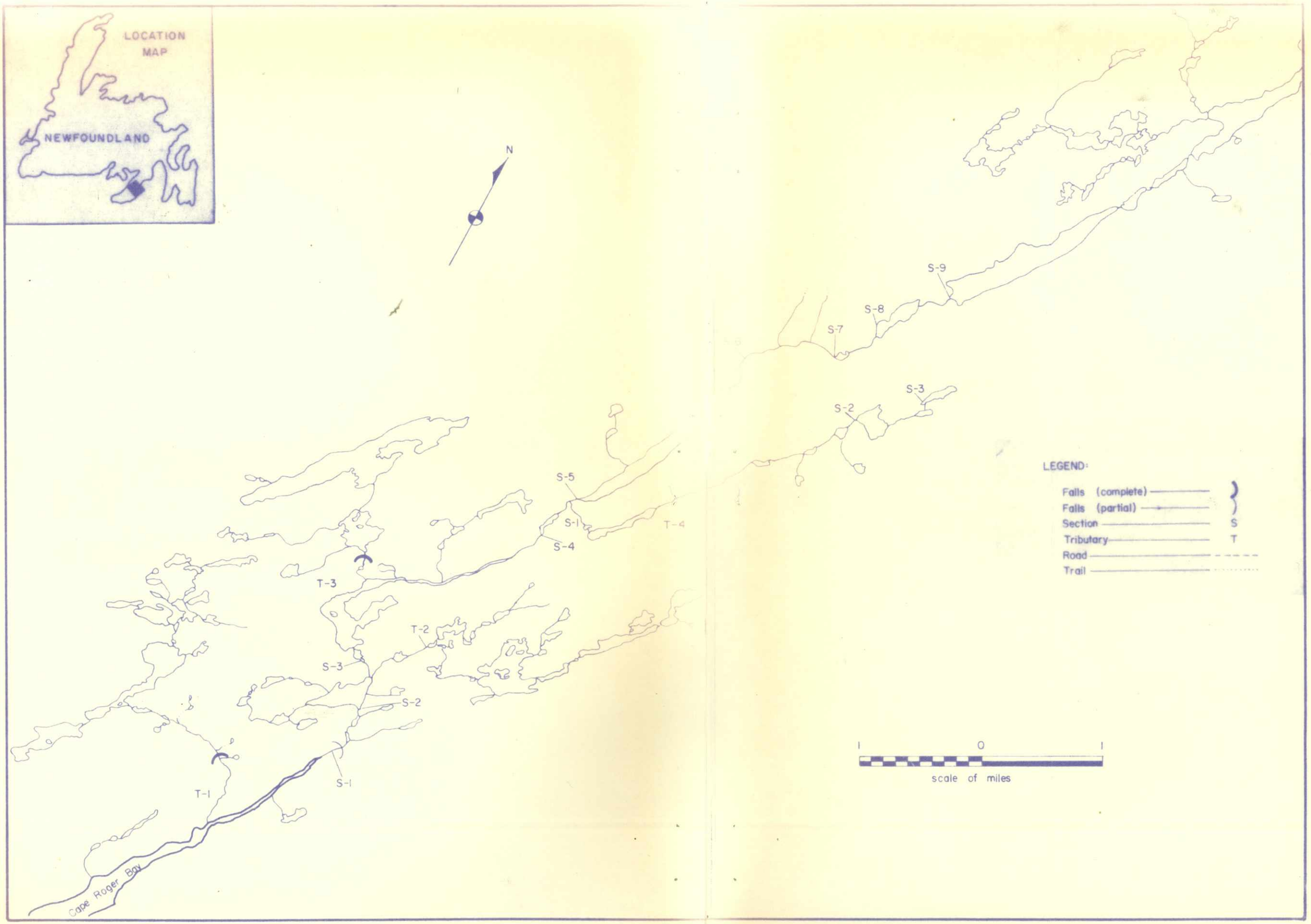

FIG. 31 OUTLINE MAP OF CAPE ROGER RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Obstructions

There is one obstruction located on the main river. A falls with an overall vertical height of 20' in 100' is located approximately 1.5 miles from the mouth. In 1956 remedial work was carried out by Resource Development Branch. Construction of a rock filled wooden dam confined water to one channel. Four benches in the falls were lowered by rock-cutting. This falls now presents very little problems to migrating fish at any water level. However, the wooden rock-filled dam has severely deteriorated and should be replaced by concrete in the near future. Minor blasting to remove a bedrock outcrop on the second drop from top is also required.

A 12' vertical falls approximately 1/2 mile from the mouth of tributary #1 completely halts fish passage (fig. 33). T-3 has a 25' high falls $\frac{1}{2}$ mile from the mouth. This also forms a complete barrier to migrating fish. Lack of rearing area above (fig. 31) eliminates the need for improvements to these obstructions.

Fig. 32. Falls 1.5 mi. from mouth of Cape Roger River

Fig. 33. Falls .5 miles from mouth of T-3

Bottom Composition

Table XXXI: Bottom composition, main stem, Cape Roger River.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units (inc.in rearing)
1	5,500	50	rubble/boulder	306	100	306	2	6
2	3,000	40	boulder/rubble	133	100	133	-	-
3	1,500	60	boulder/rubble	100	100	100	-	-
4	7,000	45	gravel/rubble	350	100	350	95	333
5	2,000	60	steadies	133	-	-	-	-
6	2,500	40	gravel/rubble	111	100	111	95	105
7	3,000	35	rubble/gravel	117	100	117	20	23
8	2,000	30	rubble/boulder	67	100	67	-	-
9	1,500	25	rubble/boulder	42	100	42	-	-
Total				1359	90.2	1226	34.4	467

An additional 15 units of boulder/rubble rearing is located between ponds near the headwaters.

Table XXXII: Bottom composition tributaries of Cape Roger River.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units (inc in rearing
T-1	3,000	15	rubble/boulder	50	100	50	-	-
T-2	3,000	15	rubble/boulder	50	100	50	-	-
T-3	2,000	40	boulder/rubble	89	100	89	-	-
T-4-S-1	1,000	15	boulder/rubble	17	100	17	-	-
T-4-S-2	7,500	10	rubble/boulder	83	100	83	2	2
T-4-S-3	1,000	5	rubble/boulder	6	100	6	-	-
Total				295	100	295	0.7	2

Fig. 34. Mouth of Cape Roger River

Fig. 35. Spawning area in middle reaches of Cape Roger River

Fig. 36. Rearing area near headwaters of Cape Roger River

Table XXXIII: Summary, bottom composition, main stem and tributaries, Cape Roger River.

	Units of rearing	Units of spawning	(inc. in rearing)
Main river	1,226	467	
Headwaters	15	-	
Tributaries	295	2	
Total units	1,536	469	

Potential population estimation

Table XXXIV: Estimated Atlantic salmon smolt production and adult sea survival - Cape Roger River and tributaries.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		1,536	3,072	4,608
Adult return if sea survival is	5%	77	154	230
	10%	154	307	461
	15%	230	461	691
	20%	307	614	922
	25%	384	768	1,152

Summary

There are no obstructions on Cape Roger River that require engineering surveys or remedial action. The falls located 1.5 miles from the river mouth requires minor blasting and repairs. Work carried out in 1956 has now fallen into disrepair.

Recommendations

Engineering stream remedial action at 1.5 miles falls to repair cribbing and dams from early stream clearance.

RED HARBOUR RIVER

Watershed Description

This small stream on the Burin Peninsula flows southeasterly and empties into the west side of Placentia Bay near the community of Red Harbour. Drainage area of the river is 28.3 miles^2 and the total axial length is 4.3 miles.

During the survey water levels were extremely low. Spawning areas are well distributed on the main stem and considered good to medium quality (table 37 and table 38). Banks are fairly steep throughout the river and good shade is provided from overhanging trees. There was a noticeable lack of good pools on the main stem.

Eight falls are located on the main stem, one of which completely halts upward migration of fish (fig. 37). This falls cuts off 5 miles of main stem to anadromous fish. A 40' vertical falls near the mouth of T-1 halts fish movement in this direction also (fig. 47).

Fish populations

Table XXXV: Atlantic salmon angling catch, Red Harbour River, 1962 - 1971.

	Total number	Av. no per year	Total wt. (lbs)	Av. wt. (lbs)
Grilse	250	25	969	3.9
Salmon	2	0.2	13	6.5
Total	252	25	982	3.9

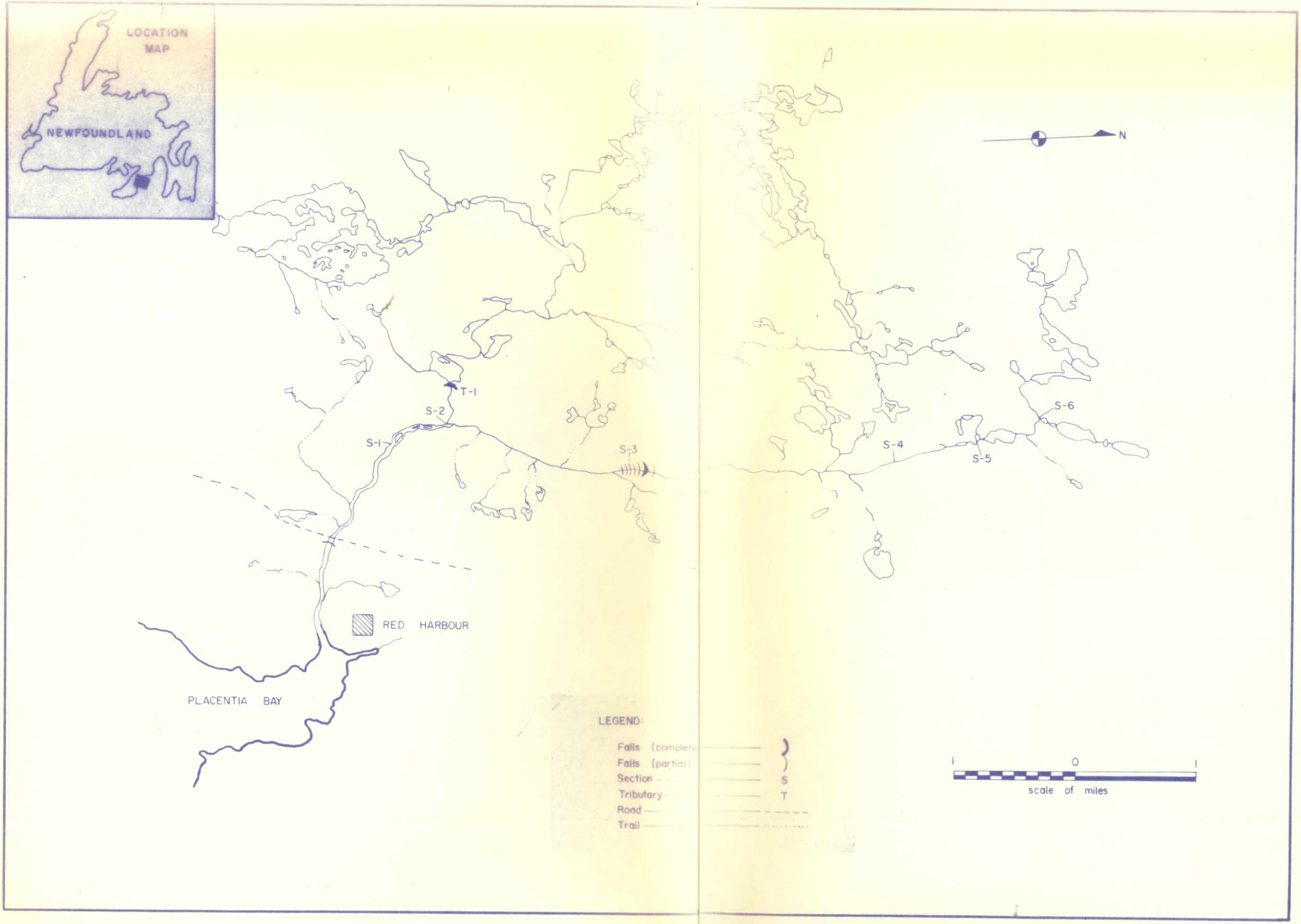

FIG. 37 OUTLINE MAP OF RED HARBOUR RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Obstructions

There are a total of eight falls on the main stem and one on tributary #1. (table XXXVI) (figs. 38 to 46). Falls #7 is a complete barrier to migrating fish at all water levels while #1 and #4 present serious problems to upward movement of fish. Table XXXVI lists the various obstructions on the main river and tributary #1.

Table XXXVI: Obstructions, Red Harbour River.

Obst. no.	Obst. type	Location from mouth	Description	Degree of obstruction	Recommended improvements
*1	falls	0.5 mi.	11' vertical overhanging lip	complete low water, passable with difficulty other levels	blast off overhanging lip. Raise level of water in pool below
2	falls	4.5 mi.	6' high, 90° LHS, 50° RHS	passable at high water	blasting to confine water to RHS
3	falls	4.5	7' high overall 2 vertical drops lower 5', upper 2'	passable at high water	improve lower drop by blasting
4	falls	4.7	6 - 7'high, 10' long @ 50°	passable with difficulty high water, complete low water	removal of huge boulder at top of falls
5	falls	4.7	10' vertical overhanging lip	complete except at high water	blast off overhanging lip
6	falls		5' vertical, large over-hanging lip	passable at high water, complete other levels	removal of huge boulder at top of falls
7	falls	4.9 mi.	18' high, 30' long @ 75° angle	complete all water levels	extensive blasting or fishway
8	falls	5.0 mi.	3' vertical	holdup at low water	no work required
T-1	falls	1500 ft.	40' vertical	complete all levels	no work necessary

* Gravel from bridge construction has accumulated at lower end of pool at base of falls. This has raised the level of the pool at low water thus allowing fish to pass up at low flow periods.

Improvements to falls #1 should be initiated as quickly as possible to preserve the run of fish to this stream. Fish hold up at the base of the falls for long periods and are subject to continuous poaching efforts.

All falls from #2 - #8 are located within $\frac{1}{2}$ mile section (the gorge). Most of these falls require minor blasting. Falls #7 will require extensive work. The limited rearing area above may not justify the required expenditure. This being so, the improvements to the other falls in the gorge will not be necessary at this time.

Fig. 38. Falls No. 1 Red Harbour River, partial obstruction.

Fig. 39. Falls No. 1, close-up view, Red Harbour River

Fig. 40. Falls No. 2, Red Harbour River, passable high water

Fig. 41. Falls No. 3, Red Harbour River, passable high water

Fig. 42. Falls No. 4, Red Harbour River, passable with difficulty high water

Fig. 43. Falls No. 5, Red Harbour River, passable high water

Fig. 44. Falls No. 6. Red Harbour River, passable high water

Fig. 45. Falls No. 7. Red Harbour River, complete all water levels

Fig. 46. Falls No. 8, Red Harbour River, holdup at low water

Fig. 47. Falls T-1, Red Harbour River, complete all levels

Bottom Composition

Table XXXVII: Bottom composition accessible area of Red Harbour River above falls #1.

Sect.	Dist (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning (inc.in units rearing
1	4,500	50	rubble/boulder	250	100	250	-	-
2	2,500	50	gravel/rubble	139	100	139	80	111
3	7,000	30	gravel/rubble	233	100	233	60	140
T-1	1,500	25	boulder/rubble	42	100	42	-	-
Total				664	100	664	37.8	251

Table XXXVIII: Bottom composition, main stem of Red Harbour River above gorge section.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning (inc. units in rearing
4	9,500	30	gravel/rubble	317	100	317	70	222
5	3,500	25	rubble/bedrock	97	70	68	-	-
6	2,000	25	boulder/rubble	56	100	56	-	-
Total				470	93.8	441	47.2	222

Bottom composition above the 40' falls on tributary #1 is not included in Table XXXVII. The limited area available above this falls obviously eliminates the need for extensive fish passage facilities. The gorge section on the main river (approx $\frac{1}{2}$ mile long) has also been eliminated from rearing area estimates.

Table XXXIX: Summary, bottom composition, Red Harbour River.

	Rearing Units	Spawning Units (inc. in rearing)
Below gorge	664	251
Above gorge	441	222
Total	1,105	473

Potential Population Estimations

Table XL: Estimated Atlantic salmon smolt production and adult sea survival Red Harbour River below gorge.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		664	1328	1992
Adult return if sea survival is	5%	33	66	100
	10%	66	133	199
	15%	100	199	299
	20%	133	266	398
	25%	166	332	498

Table XLI: Estimated Atlantic salmon smolt production and adult sea survival - Red Harbour River above gorge.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		441	882	1323
	5%	22	44	66
	10%	44	88	132
	15%	66	132	198
	20%	88	176	265
	25%	110	221	331

Summary

Red Harbour River offers little in the way of stream potential for Atlantic salmon. Stream clearance work on the main river at eight (8) obstructions would be required to make available 1100 units of rearing.

Minor stream clearance work should be initiated as soon as possible on falls #1. The high cost of improvements coupled with the small area above places the others on a very low priority.

Recommendations

Engineering survey on lower falls; no further work above.

SALMONIER BROOK

Watershed Description

Salmonier Brook enters the sea on the west side of Burin Bay Arm on the Burin Peninsula (fig. 48). It has a watershed of 12.9 miles^2 and an axial length of 7.6 miles.

Spawning and rearing areas on the brook are of poor quality due to large concentrations of silt apparently caused by road construction. Gravel is plentiful throughout most of the river but much of it is small and more suitable for trout spawning. At survey time, water levels ranged from 6 - 10" and velocities were slow to medium. Banks are gently sloping in lower reaches becoming steeper as you near the headwaters. There is a fair amount of cover from small spruce and fir along the banks.

There are two small rapids on the main stream; one near the mouth, the other just below Salmonier Pond (fig. 48). Neither of these present any problem to migrating fish.

Fish Populations

Table XLII: Angling catch, Atlantic salmon, Salmonier Brook, 1953 - 1955, 1964 & 1968-1970*, 1958, 1969.

	Total number	Av. no. per year	Total wt. (lbs)	Av. wt. (lbs)
Grilse	127	14	509	4.0
Salmon	-	-	-	-
Total	127	14	509	4.0

* There is no angling report available for 1971.

LEGEND:

Falls (complete) ——— }
Falls (partial) ——— }
Section ——— S
Tributary ——— T
Road - - - - -
Trail .....

0 1
scale of miles

FIG. 48 OUTLINE MAP OF BIG SALMONIER BROOK SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Obstructions

One small rapid near the mouth and a 3' falls below Salmonier Pond do not hinder upstream movement of fish at any water level. A 12' vertical falls at the mouth completely blocks access to a small tributary (T-1).

During the aerial survey (August 3, 1971) silting from road construction in the area had heavily damaged the whole river. Four deposits were so large, that they diverted the main river into the trees on either side. One of these deposits, measuring approximately 40' x 80', completely blocked fish passage (Fig. 49). From Salmonier Pond downstream, the whole river bottom had a coating of fine silt.

According to a report from District "B" at Grand Bank, this problem has now been cleared up to the satisfaction of this Department.

Fig. 49. Complete obstruction caused by silt from road construction

Bottom Composition

Table XLIII: Bottom Composition, main stem of Salmonier Brook

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing
1	7000	30	gravel/bedrock/sand	233	70	163	20	163	
2	4000	20	gravel/sand	89	50	45	40	36	
3	5000	15	gravel/rubble	83	95	79	50	42	
4	4000	15	rubble/gravel	67	80	54	10	7	
5	4000	15	rubble/boulder/gravel	67	100	67	-	-	
Total				539	75.7	408	46.0	248	

Potential Population Estimation

Table XLIV: Estimated Atlantic salmon smolt production and adult sea survival Salmonier Brook

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		408	816	1224
Adult return if sea survival is	5%	20	41	61
	10%	41	82	122
	15%	61	122	184
	20%	82	163	245
	25%	102	204	306

Summary

This river offers no problems to fish passage worthy of further action.

Recommendations

No further action.

GARNISH RIVER
(including Black River)

Watershed Description

Rising in the central area of the Burin Peninsula, Garnish River flows generally southward for approximately 10 miles then turns sharply and flows westward some 14 miles to enter Fortune Bay near the community of Garnish (fig. 50). The stream has a drainage area of 82 miles^2 and a total axial length of 24 miles. Locally, the watershed is divided into two areas. Garnish River itself is that portion from the mouth to and including Garnish Pond. Beyond Garnish Pond the remainder of the river is referred to as Black River. In this report, the complete watershed is considered to be Garnish River.

From the mouth to Garnish Pond the stream is wide with medium velocity and gravel/rubble bottom (fig. 53). Gravel here, except for a few areas, is not suitable for spawning due to a thick growth of aquatic vegetation on the river bed. Above Black River Pond the river again becomes very wide and meandering with several small islands. This area contains approximately four miles of good to excellent spawning gravel (fig. 57).

Beyond this gravel portion the river narrows somewhat, banks become steeper and velocity increases. This upper portion contains mostly rearing with some areas of spawning scattered throughout.

Two temporary holdups to salmon are located on the main stem at mile points 14.5 and 17.0. (fig. 50). Both are falls and require blasting to ease upstream migration of salmon.

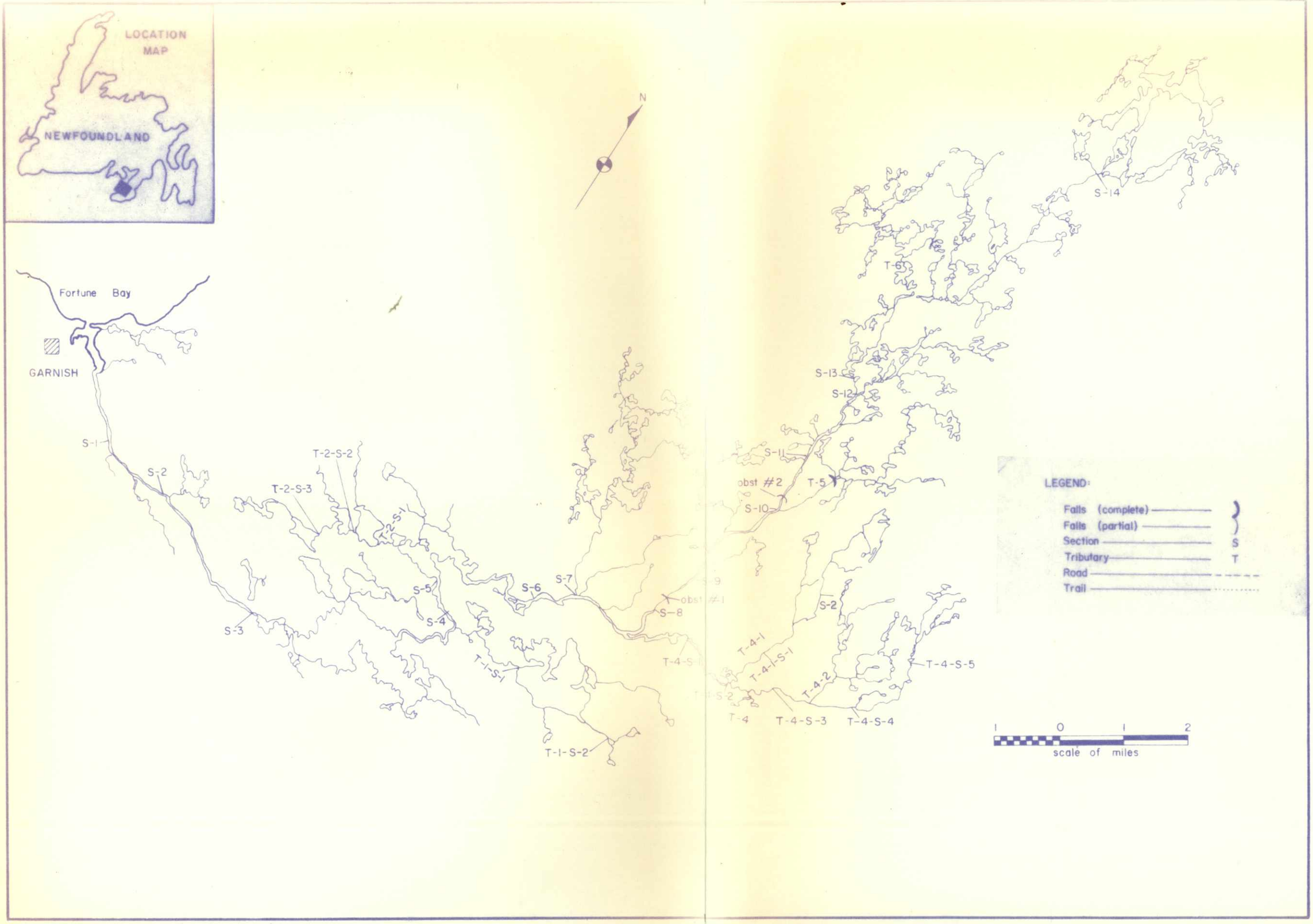

FIG. 50 OUTLINE MAP OF GARNISH RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Fish populations

Table XLV: Atlantic salmon angling catch, Garnish River, 1952 - 1956, 1958-71

	Total number	Av. no. per year	Total wt. (lbs)	Av. Wt. (lbs)
Grilse	7773	409	23,724	3.1
Salmon	8	0.5	67	8
Total	7781	410	23,791	3.1

From 1952 - 1966, the angling catch ranged from 3 fish to a maximum of 91 fish with a range of 1 - 231 rod days. From 1967 - 1971, the catch ranged from a low of 389 in 1967 to a high of 2637 in 1969. Rod days ranged from 656 to 1263 in the same period.

In 1966, a road was built from Marystown to Clam Pond on the Garnish system. A year or so later, another road was built from Marystown to Garnish Pond. These roads opened up previously inaccessible areas. This coupled with the industrial expansion and consequent population increase in the area has resulted in a trememdous pressure being placed on the Garnish system.

In 1969 a peak of 2637 fish in 1263 rod days (2.1 fish per rod day) was reached. This dropped to 2071 fish in 1318 rod days (1.6 fish per rod day) in 1970; 1971 showed 1382 fish in 1154 rod days (1.2 fish per rod day).

A spawning survey in 1971 undertaken jointly by Resource Development and Conservation and Protection Branch revealed 765 redds. Assuming a 60:40 F:M ratio, the spawning escapement was in the vicinity of 1300 fish.

Using a 3 lb. average weight and 700 eggs per lb. of female fish, the egg deposition was in the vicinity of 1,600,00. The estimated number of rearing units is 9283. From this estimate the egg deposition is 170 per unit which is more than ample to reseed the system.

Obstructions

There is a series of 4 small falls located in a gorge section 14.5 miles from the mouth of the main stem. These falls are 3 - 4' high each over a distance of 200 feet. The second falls in this series requires minor blasting to improve fish passage at low water (fig. 51). The others will not require any work.

Another falls at mile point 17 is a complete holdup at low and medium water levels, passable with difficulty at high water levels (fig. 52). This falls has a 12' vertical drop on the right hand side, 12' at 75° angle in center and a run-around on the left hand side that can be utilized only at high water levels. Blasting is required here to improve run-around and channel more water through for easy fish passage at all water levels.

T - 5 has a falls approximately one mile from the mouth (fig. 50). This falls is a complete obstruction at all water levels. No work is necessary here due to the small area above.

Fig. 51. Falls No. 1 in gorge section of Garnish River, holdup at low water

Fig. 52. Falls No. 2, Garnish River, complete except high water

Bottom Composition

Table XLVI: Bottom composition, main stem of Garnish River.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc.in rearing
1	4000	125	rubble/gravel	555	100	555	20	111	
2	6000	125	rubble/gravel	833	100	833	20	167	
3	14000	80	rubble/boulder	1244	100	1244	-	-	
4	7200	85	steadies/boulder	680	25	170	-	-	
5	3000	125	boulder/rubble	417	100	417	-	-	
6	8000	125	gravel/rubble	1111	100	1111	80	889	
7	4000	80	rubble/gravel	356	100	356	50	178	
8	8500	100	gravel/rubble	944	100	944	90	850	
9	5000	25	boulder/rubble/ bedrock	139	90	125	-	-	
10	9000	80	rubble/gravel	800	100	800	10	80	
11	4500	60	boulder/rubble	300	100	300	-	-	
12	6800	125	boulder/rubble/ gravel	944	90	850	-	-	
13	1700	60	boulder/rubble	113	100	113	-	-	
14	14000	30	boulder/rubble	467	100	467	3	14	
Total				8903	93.1	8285	25.7	2289	

Table XLVII: Bottom composition, tributaries of Garnish River

Section	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc in rearing
T-1-S-1	7000	15	boulder/gravel	117	50	59	5	6	
T-1-S-2	2000	8	boulder/rubble	18	100	18	-	-	
T-2-S-1	2000	4	steady	9	-	-	-	-	
T-2-S-2	500	4	rubble/boulder	2	100	2	-	-	
T-2-S-3	2000	4	steadies	9	-	-	-	-	
T-3-S-1	8000	15	rubble/boulder	133	100	133	-	-	
T-3-S-2	10,000	10	rubble/boulder	111	100	111	-	-	
T-4-S-1	4,500	60	steadies	300	-	-	-	-	
T-4-S-2	5,500	25	gravel/rubble	153	100	153	90	138	
T-4-S-3	4,500	20	gravel/rubble	100	100	100	5	5	
T-4-S-4	6,000	15	rubble/gravel	100	100	100	20	20	
T-4-S-5	7,000	15	rubble/boulder	117	100	117	-	-	
T-4-1-S-1	3,000	10	gravel/rubble	33	100	33	10	3	
T-4-1-S-2	10,000	10	rubble/boulder	111	100	111	-	-	
T-4-2	5,500	10	rubble/boulder	61	100	61	-	-	
Total				1374	72.6	998	12.5	172	

Table XLVIII: Summary, bottom composition Garnish River and tributaries.

	Rearing units	Spawning units	(inc. in rearing
Main river	8285	2289	
Tributaries	998	172	
Total	9283	2461	

Potential Population Estimation

Table XLIX: Estimated Atlantic salmon smolt production and adult sea survival, Garnish River and tributaries.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		9283	18566	27849
Adult survival if sea survival is	5%	464	928	1392
	10%	928	1857	2785
	15%	1392	2785	4177
	20%	1857	3713	5570
	25%	2321	4642	6962

Fig. 53. Garnish River near the mouth

Fig. 54. Steady section above Garnish Pond

Fig. 55. Rearing area main stem of Garnish River

Fig. 56. Pool on Garnish River, approximately ½ mile above Black River Pond

Fig. 57. Typical spawning area above Black River Pond

Summary

There are two sets of falls on this river located at 14.5 miles and 17 miles on the main stem. Both obstructions are classed as partial. The value of Garnish River as a producer in recent years makes removal of these obstructions essential for fast passage of fish upstream beyond the poacher net.

Recommendations

Removal of obstructions as soon as possible - priority high.

TERRENCEVILLE BROOK

Watershed Description

Terrenceville Brook flows into the bottom of Fortune Bay on the south coast of Newfoundland near the community of Terrenceville (fig. 58). The stream has a drainage area of 44.3 miles^2 and a total axial length of 10.2 miles.

From the mouth upstream three and one-half miles to the gorge, the river consists mainly of rubble/gravel with flat grassy banks and a slow to medium flow. Several good spawning areas are located along this section.

A gorge approximately 100 yards long is located approximately 3.5 miles from the mouth. There are seven falls in the gorge with a total height of 100'. (fig. 59). Three of these falls form complete barriers to migrating fish and the others are classed as very difficult. Above the gorge spawning and rearing areas are well distributed (table LIII). Except for a small falls (holdup at low water) three-quarter mile above the gorge, the upper reaches of the river are free from obstructions.

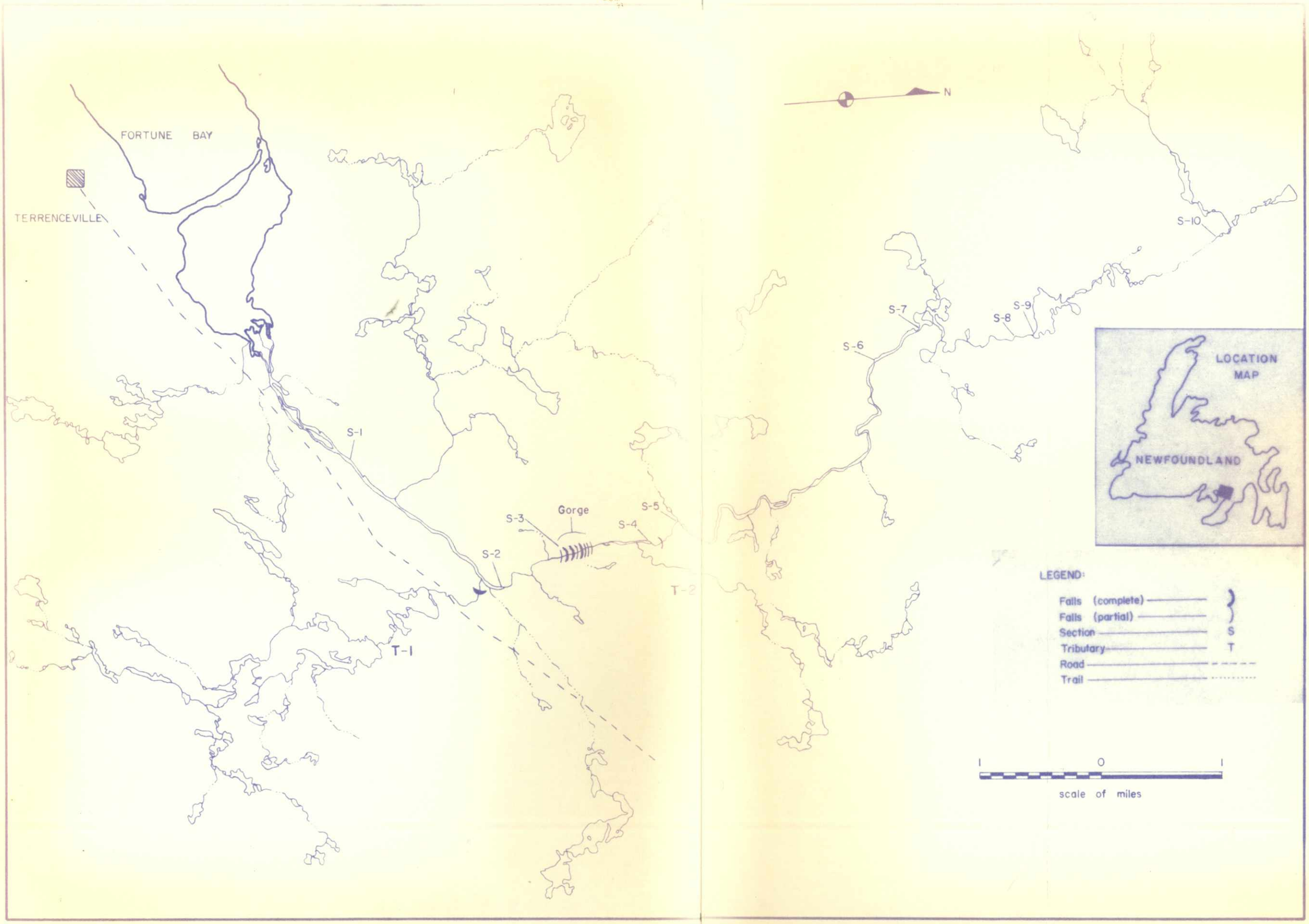

FIG. 58 OUTLINE MAP OF TERRENCEVILLE RIVER SHOWING OBSTRUCTION LOCATIONS AND SECTIONS SURVEYED.

Fish Populations

Table L: Atlantic salmon, angling catch, Terrenceville Brook - 1952-1958, 1960, 1962-1971.

	Total number	Av. No. per year	Total wt. (lbs)	Av. wt. (lbs)
Grilse	258	18	889	3.4
Salmon	17	1	141	8.3
Total	275	19	1030	3.7

No salmon were angled on Terrenceville Brook in 1970 or 1972.

Obstructions

Approximately 3.5 miles from the mouth, there is a series of seven falls in a 100 yard long gorge (fig. 59). Total overall height is one hundred feet. Table LI lists the various falls and the degree of obstruction of each.

Table LI: Obstructions, gorge section of Terrenceville Brook

Falls number (from downstream end)	Description	Degree of obstruction
1	15' high, 50° slope	Passable with difficulty
2	20' vertical	Complete
3	15' high, 75° slope	Complete
4	10' vertical	Passable with difficulty
5	20' vertical	Complete
6	10' 45° slope	Passable
7	10' 45° slope	Passable

To open up the upper section of Terrenceville Brook, three fishways would be required in this gorge and extensive remedial work required on the other falls. The high cost of such an undertaking plus the limited available areas above obviously places this stream on a very low priority for future work.

Fig. 59. Aerial view of gorge on Terrenceville Brook

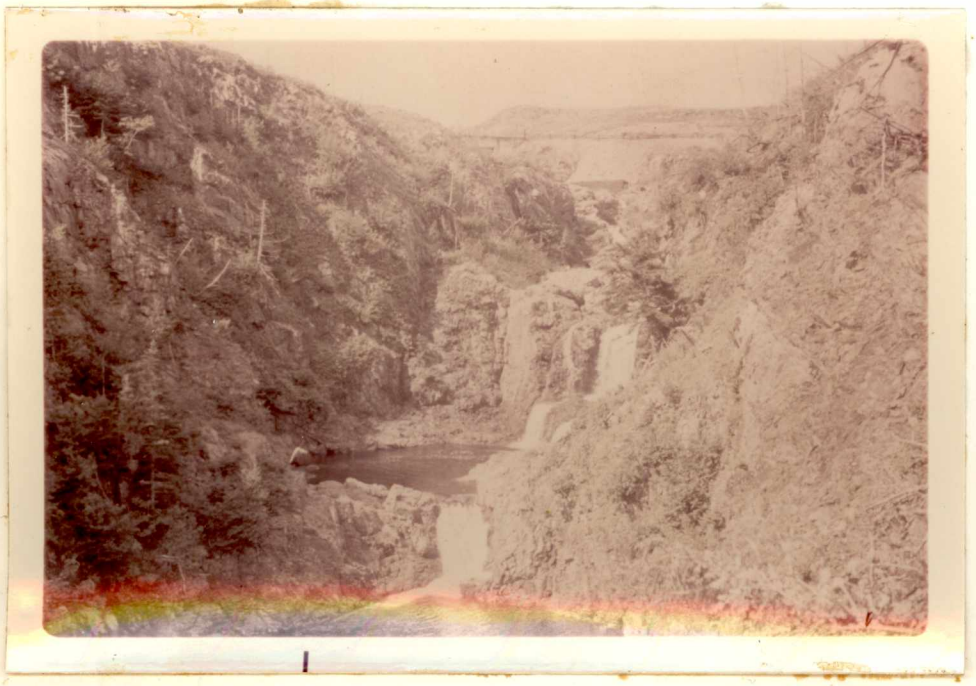

Fig. 60. Falls no. 3, 4 and 5 Terrenceville Brook

Bottom Composition

Table LII: Bottom composition, Terrenceville Brook below obstruction #1.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc in rearing
1	5,500	60	rubble/gravel	367	100	367	50	184	
2	9,000	40	rubble/gravel	400	100	400	40	160	
3	3,000	30	boulder/rubble	100	100	100	-	-	
Total				867	100	867	39.7	344	

One tributary enters the main stem below the series of complete obstructions. This tributary is also blocked by an impassable falls a few hundred feet from the mouth.

Table LIII: Bottom composition, Terrenceville Brook above series of complete obstructions on main stem.

Sect.	Dist. (ft)	Width (ft)	Bottom type	Total units	Rearing %	Rearing units	Spawning %	Spawning units	(inc. in rearing
4	3,000	35	gravel/rubble	117	100	117	80	94	
5	2,000	20	rubble/boulder	44	100	44	-	-	
6	17,000	30	gravel/sand/rubble	567	80	454	60	340	
7	2,000	45	steady	100	-	100	-	-	
8	5,000	20	gravel/sand	111	60	67	70	78	
9	1,000	15	boulder/rubble	17	100	17	-	-	
10	6,000	15	boulder/rubble	100	100	100	-	-	
T-2	8,000	8	gravel/rubble	71	100	71	70	50	
Total				1,127	86.1	970	49.9	562	

Table LIV: Summary, bottom composition, Terrenceville Brook

	Rearing units	Spawning units (inc. in rearing)
Main river below complete obstruction #1	867	344
Main river & T-2 above obstruction #1	970	562
Total	1,837	906

Potential Population Estimation

Table LV: Estimated Atlantic salmon smolt production and adult sea survival, Terrenceville Brook, below series of complete obstructions.

If smolt production per 100 yds^2 is		1	2	3
Smolts produced		867	1,734	2,601
Adult return if sea survival is	5%	43	87	130
	10%	87	173	260
	15%	130	260	390
	20%	173	347	520
	25%	217	434	650

Table LVI: Estimated Atlantic salmon smolt production and adult sea survival, Terrenceville Brook above series of complete obstructions.

If smolt production per 100^2 yds is		1	2	3
Smolts produced		970	1940	2910
Adult return if sea survival is	5%	49	97	146
	10%	97	194	291
	15%	146	291	437
	20%	194	388	582
	25%	243	485	728

Summary

Extensive construction and stream remedial work would be required to open up less than 1000 units of rearing area. From the biological investigations this does not appear feasible at the present time.

Recommendations

No further Biological or Engineering investigations.

Table LVII: Summary of rearing and spawning areas above complete obstructions on Burin Peninsula Rivers.

River	Obstruction	Distance from mouth (mi)	Rearing units above	Spawning units above	Remarks
Pipers Hole	10' falls	5.0	3800	400	Blasting required to enlarge pool
	30' vertical falls	11.2	Nil	-	2 fishways required
	15' vertical falls	11.2	2650	15	
Sandy Harbour	18' vertical falls	2.5	6550	1900	partial obstruction above requires stream remedial
Paradise	45' vertical	0.25	3650	1750	
	12' vertical	6.0	850	30	engineering surveys
	15' high, 25' long at 50°	6.7	6350	850	
Black River	12' vertical overhanging lip	0.5	Nil	Nil	several partial obstructions
	12' in two drops, upper 3', lower 9' vertical	0.6	450	150	require blasting etc. (table XXI)
	15' vertical falls	2.0	250	Nil	
	12' overall 2 drops, 7' and 5'	3.0	1100	75	

Table LVII: (cont'd)

River	Obstruction	Distance from mouth (mi)	Rearing units above	Spawning units above	Remarks
Red Harbour	18' high 30' long at 75° angle	4.9	450	225	several partial obstructions require blasting (table XXXVI)
Terrenceville	20' vertical	3.5	Nil	Nil	Series of falls in gorge, overall height 100 feet (table LI)
	15' at 75°	3.5	Nil	Nil	
	20' vertical	3.5	1000	550	

List of photographs (color slides) placed in general photo file from streams included in this report.

RIVER	PHOTOGRAPH NUMBERS
Pipers Hole River	1165-1169
Sandy Harbour River	1170-1173
Paradise River	1174-1178
Black River	1179-1184
Nonsuch River	1185-1187
Cape Roger River	1197-1201
Red Harbour River	1188-1196
Salmonier Brook	
Garnish River	1202-1208
Terrenceville River	1209

REFERENCES

Davis, H.S. 1938. Instructions for conducting stream and lake surveys. N.S. Bur. Fish. Fish. Circ. 26 55p.

Lagler, K.F. 1956. Freshwater fishery Biology, 2nd. ed., W.C. Brown Co., Dubuque, Iowa.

Murray, A.R. 1968. Smolt survival and adult utilization of Little Codroy River, Newfoundland, Atlantic Salmon. J. Fish. Res. Bd. Canada, 25: 2165-2218.

Riche, L.G. 1972. An outline of methods used in stream surveys and estimation of salmon production; with a suggested value for Atlantic Salmon Sports Fish in Newfoundland Resource Dev. Branch, Fish. Serv., St. John's, Nfld.